

PATENT COOPERATION TREATY

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INTERNATIONAL PRELIMINARY EXAMINATION REPORT (PCT Article 36 and Rule 70)

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Applicant's or agent's file reference JOO/PCT/NO03/00296	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA416)	
International application No. PCT/NO 03/00296	International filing date (day/month/year) 26.08.2003	Priority date (day/month/year) 26.08.2002
International Patent Classification (IPC) or both national classification and IPC C25B11/02		
Applicant ORO AS et al.		



1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 4 sheets, including this cover sheet.

☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 5 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the opinion
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand 25.03.2004	Date of completion of this report 06.12.2004
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized Officer Del Piero, G Telephone No. +49 89 2399-8579 

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No.

PCT/NO 03/00296

I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

Description, Pages

1-19 as originally filed

Claims, Numbers

1-26 filed with telefax on 12.11.2004

Drawings, Sheets

1/6-6/6 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:
- ☐ the drawings, sheets:

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. **PCT/NO 03/00296**

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	1-26
	No: Claims	
Inventive step (IS)	Yes: Claims	1-26
	No: Claims	
Industrial applicability (IA)	Yes: Claims	1-26
	No: Claims	

2. Citations and explanations

see separate sheet

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/NO 03/00296

V.

1. The three-layer electrode structure as specified in present claim 1 is neither disclosed in nor fairly derivable from the closest state of the art on record as represented by US-B-6 274 009, particularly based on the spacer and the frame having the same planar configuration.

The same conclusion applies, by implication, to independent claim 12, directed to a method for preparing said electrode and to claim 14, directed to its use.

2. The possibility of electrolytically treating a liquid with improved efficiency (reduction of the amount of costly electrode materials, low operational voltages, higher current densities ...) justifies the acknowledgment of an inventive step.

AMENDED PATENT CLAIMS

1. Structure of an electrode of electrically conducting
5 material for use as an anode and/or a cathode in an
electrolytic cell, and comprising a spacer means to prevent
electrical contact between electrodes when used, and being
arranged for through flow conducting of a process liquid,
such as water, to be treated, characterised by,

10 a conductive frame (10) having a number of liquid
through flow openings (18) and including means (20) for
connection to a current supply,

one or both plane sides of the frame (10) is covered
with a conductive perforated foil or a wire mesh (12,14),
15 and

the spacer means (16) is a perforated foil or wire mesh
being adapted to cover one of the plane surfaces of the
perforated foil or a wire mesh (12,14), and the plane
section of said spacer foil corresponds mainly to the plane
20 section of the frame (10).

2. Structure of an electrode according to claim 1,
characterised in that the wire mesh or wire mesh net
(12,14) includes parallel threads where each tenth or
25 twentieth threads is of tantalum while the intermediate
threads are of platinum.

3. Structure according to claims 1-3, characterised in
that the wires of the wire mesh (12,14) are individually
30 from 100 microns to 25000 microns apart, and when they are
woven, knitted, induction-welded or plaited into mesh, have
an air aperture of from 15 microns to 25000 microns.

4. Structure according to any of preceding claims,
35 characterised in that each wire has a diameter in a range
of 0.010 mm to 5 mm.

AMENDED SHEET

AMENDED SHEET

NO 03 002 96

5. Structure according to any of preceding claims,
characterised in that the foil or a wire mesh (12,14) is
formed of tantalum, niobium, hafnium, zirconium, platinum,
rhodium, iridium, ruthenium, palladium or any alloy of
5 these, or of an alloy or an composition of wires of the
different aforementioned metals.

6. Structure according to any of preceding claims,
characterised in that the foil electrode (12,14) consists
10 of a plate in SS316L or higher alloy metal which is closely
perforated by photochemistry.

7. Structure according to any of preceding claims,
characterised in that the through-flow openings (18) of the
15 spacer means (16) are aligned with the through flow
openings (18) of the frame (10).

8. Structure according to any of preceding claims,
characterised in that the spacer foil (16) is a PVC or
20 polypropylene sheet and is welded to the frame (10).

9. Structure according to any of preceding claims,
characterised in that the thickness of the frame (10) is
about 5 mm.

25 10. Structure of electrode according to any of preceding
claims, characterised in that the frame (20) is covered
with a non oxidizable material in order to protect against
contact with the mentioned process liquid.

30 11. Structure according to any of preceding claims,
characterised in that the foil thickness is from 25-1000
microns and diameter of each perforation from 25-2000
microns.

12. Method for preparing an electrode according to claim 1, characterised in that perforated foil or wire mesh sheets (12,14,16) are anchored to the frame (10) by subjecting the perforated foil or wire mesh sheets to a stretch or tension force, and then being forced against and fixed to the frame surface by means of a welding and/or adhesive operation.

13. Method according to claim 12, characterised in that the perforated foil or wire mesh sheets (12,14,16) are anchored to the frame (10) by friction welding, laser welding or preferably by use of pressure/heat and bonding and exposing the foil or wire mesh to said sufficient tension force.

14. Use of the electrode structure according to claims 1-11, in an electrolytic cell where single electrodes according to said claims are stacked and interconnected to form anode/cathode pairs in numbers from one and up to 50 altogether inside a pipe, for processing of liquids/water being conducted through the electrode-pairs of the cell in the pipe, in that a current is applied to each pair of anode and cathode.

15. Use of electrode structure according to claim 14 in an electrolytic cell processing liquids/water where the anode and cathode is of identical material or different, and in case of similar material, a direct current DC power applied might be alternated to avoid scaling and uneven tear and wear.

16. Use of electrode structure according to any of claims 14-15 in an electrolytic cell processing liquids/water in that the flow capacity might be from a few litres/hour and up to more than 1000 m³/hour.

17. Use of electrode structure according to claims 14-16 in an electrolytic cell processing liquids/water in that a

AMENDED SHEET

typical current density at 316L anodes is 38 mA/cm² provided a Cl content at 5 ppm, and for noble metals the current is 270 Amp at an anode area of 0,5 cm², and the distance between the anode surface of one electrode unit and the cathode surface of the neighbouring electrode unit may be about 0,3 mm.

18. Use of anode and cathode according to the preceding claims 14-17, in an electrolytic cell, for production of oxidants through electrolysis, for oxidation of organic material in liquids, and organic material on particles in liquids.
19. Use of anode and cathode according to the preceding claims 14-18, in an electrolytic cell, for production of oxidants through electrolysis, for oxidation and destruction of bacteria, spores, micro-organisms, algae and virus in liquids.
20. Use of anode and cathode according to the preceding claims 14-19, in an electrolytic cell, for production of oxidants through electrolysis, for treatment of fresh water and drinking water.
22. Use of anode and cathode according to the preceding claims 14-21, in an electrolytic cell, in which polluted liquid/water is conducted through the through flow openings (18) of anode and cathode of the cell.
23. Use of anode and cathode according to the preceding claims 14-22, in an electrolytic cell, for production of oxidants through electrolysis, for destruction of virus, spores and bacteria, and micro organisms, algae and algal cysts smaller than 100 microns in ballast water from ships.
24. Use of anode and cathode according to the preceding claims 14-23, where the liquid that is being treated, before it is treated according to the invention, is

AMENDED SHEET

24

directed through a mechanical particle extractor in order to remove all particles and organisms larger than light aperture in the electrode.

- 5 25. Use of the anode and cathode according to the preceding claims 14-24, where the liquid that has been treated, after it is treated according to the invention, is directed through an hydrophobic adsorption filter or hydrophobic adsorption media in order to remove potential
10 excess organic compounds.

26. Use of the anode and cathode according to the preceding claims 14-25, where the liquid while treated is directed through a flotation device in order to remove
15 electro floated organic material.

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